



Limited Access to Services in Canadian Rural Emergency Departments: A Preliminary Study

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Limited Access to Services in Canadian Rural Emergency Departments: A Preliminary Study

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RUNNING HEAD: Access to rural emergency services in Canada

KEYWORDS: Emergency departments, Health services, Rural critical care, Rural emergency medicine, CT scan

ABSTRACT

Objective: To examine 24/7 access to services and consultants in a sample of Canadian rural emergency departments (EDs).

Design: Cross-sectional study - mixed methods (structured interview, survey and government data bases) with random sampling of hospitals.

Setting: Canadian rural EDs (rural small town definition - Statistics Canada).

Participants: 28% (95/336) of Canadian rural EDs providing 24/7 physician coverage located in hospitals with acute care hospitalization beds.

Main outcome measures: General characteristics of the rural EDs, information about 24/7 access to consultants, equipment and services, and the proportion of rural hospitals more than 300 km from Level 1 and 2 trauma centers.

Results: Of the 336 rural EDs identified, 122 (36%) were contacted and 95 participated in the study (participation rate, 78%). Hospitals had, on average, 23 acute-care beds, 7 ED stretchers and 13,500 annual ED visits. The proportion of rural hospitals with local access to the following 24/7 services was: pediatrician, 5%; obstetrician, 10%; psychiatrist, 11%; internist, 12%; intensive care unit, 17%; CT scanner, 20%; surgeon, 26%; ultrasound, 28%; basic X-ray, 97%; and laboratory services, 99%. Forty-four and 54 percent of the RST EDs were more than 300 km from a Level 1 and Level 2 trauma center, respectively.

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Conclusions: This is the first study describing the services available in Canadian rural EDs. Apart from basic laboratory and X-ray services, most rural EDs have limited access to consultants, advanced imaging and critical care services. A detailed study is needed to evaluate the impact of these limited services on patient outcomes, costs and interfacility transport demands.

Trial registration: Not a registered trial.

ARTICLE SUMMARY

Article focus

- Examine and describe 24/7 access to comprehensive support services in a random sample of Canadian rural emergency departments (EDs).

Key messages

- Apart from basic laboratory and X-ray services, most Canadian rural EDs have limited 24/7 local access to consultant and imaging services.
- A considerable proportion of these rural hospitals are more than 300 km from Level 1 and 2 trauma centers.

Strengths and limitations of this study

- To the best of our knowledge, this is the first nationwide study examining access to services in Canada's rural EDs.
- The current study does not permit representative comparisons between provinces, since a sample of rural EDs was included in this study.
- The study did not examine patient outcomes in relation to the limited services provided in rural facilities.

INTRODUCTION

Approximately 20% of the Canadian population lives in rural or remote areas[1]. Providing sustainable access to emergency care in these areas is challenging[2]. In the context of limited resources and increased costs, there have been increased efforts to regionalize and centralize health-care services in rural Canada[3-6]. This has resulted in local service cuts and hospital closings[5 6]. Therefore, the current level of services offered in rural hospitals in Canada is unclear. Published data on the subject are scarce, and access to updated resource databases is both limited and sensitive[7]. Despite the accessibility clause of the *Canada Health Act*[8], the legislation overseeing the country’s publically funded universal health care-system, disparities in access to emergency care may exist.

Facing similar challenges, the US developed, in 1997, the Critical Access Hospital (CAH) Program to enhance access to health care in rural communities[9]. This legislation enables CAHs to receive cost-based reimbursement for Medicare beneficiaries with the goal of financially stabilizing hospitals in small and remote areas. The legislation also sought to enhance quality by imposing credentialing and quality assurance requirements. Yet, despite the creation of this program, recent reports showed that compared to non-CAH hospitals, CAH hospitals had fewer clinical capabilities, worse processes of care, and higher mortality rates for acute myocardial infarction, congestive heart failure and pneumonia[9] and ischemic stroke[10].

To the best of our knowledge, no comparable Canadian study has been conducted. While the vast majority of US rural hospitals have 24/7 local access to a CT scanner (94%)[11], surgical services (87%) and a significant proportion of ICUs (41%)[9], preliminary reports from Canada[6

12] show that, at least in British Columbia, less than 15% of rural EDs have local 24/7 access to these services.

Limited access to services in rural areas may preferentially impact the provision of quality emergency care. The principles of emergency medicine rest on timely diagnosis and definitive treatment of life- or limb-threatening conditions. Timely access to diagnostic imaging and consultant support and tertiary trauma centers are essential components of emergency care. A lack of these services leads to an increased need for interfacility transport, with a resultant impact on staff, medical resources, technological support, transfer systems, local and referral center resources, patient costs, and patient safety[13 14]. Patient transfers also result in significant delays in providing definitive care[15], particularly in rural communities[16-19]. Moreover, in these communities, the risk of trauma and trauma death is greater than in urban areas[19-23], especially during the prehospital period[21 22].

The objective of this study was to examine and describe the current situation concerning access to comprehensive health-care services in a sample (25%) of Canadian rural hospitals with a view to planning an intervention to address the causes of a lack of access to comprehensive health care in rural Canada.

METHODS

The protocol was submitted to our internal ethics review board (CHAU Hôtel-Dieu de Lévis) in June 2011. It was deemed not to require further ethics evaluation, based on the Tri-Council Policy Statement, as the research focused on the availability of services in public health-care facilities and did not involve human subjects.

Selection of rural EDs

We focused on rural EDs with 24/7 physician coverage at hospitals with acute-care hospitalization beds. To facilitate eventual comparisons with EDs elsewhere, we excluded community health centers and clinics, nursing stations, mobile health units, and private facilities. We consulted the Division of Geography at Statistics Canada to use their definition of “rural and small town” (RST)[24] (see Appendix 1). Briefly, they consider RSTs “towns and municipalities outside the commuting zone of larger urban centers (i.e. outside the commuting zone of centers with a population of 10,000 or more)”.

EDs in RST communities were then identified using the *Guide to Canadian Healthcare Facilities*[25]. The hospitals’ status was then confirmed with the provincial health ministries by phone or e-mail. Furthermore, the list of RSTs where the participating centers were located was submitted to Statistics Canada for confirmation. In the end, 336 RST EDs were identified.

Procedure for random sampling

The complete list of the 336 rural EDs, stratified for the provinces and territories, was submitted to an independent biostatistician, who generated a list of randomly ordered hospitals within each stratum. Our objective was to obtain data from at least 25% of the hospitals in each province and territory. To allow for the refusal to participate, the first 36% (n=122) of the hospitals listed within each stratum were initially contacted.

Data collection

As a first step, we sought to obtain data on ED patient volumes, local 24/7 access to consultant

support, imaging services, access to intensive care unit (ICU) beds, and the distance to designated Level 1 and Level 2 trauma centers (see Hameed *et al.*[26] for the definition and identification of trauma centers), which was calculated with Google Maps[27]. This Web-based mapping/geographic information system provides valid estimates of road distances at low cost, it has fewer usability problems than other similar systems[28], and it has been used previously in health care[29 30].

Data were collected between July and December 2011 by research assistants as well as medical students doing a research rotation. Data were collected from a questionnaire completed by the ED managers, and when necessary, a brief (10-minute) telephone interview was administered to complete the missing data. Government databases and official websites (e.g., those of provincial health ministries) were also used as sources of information.

Data entry and analysis

All data entry was verified by a second research assistant. Descriptive statistics are presented as percentages, means and standard deviations (SDs).

RESULTS

Of the 336 rural EDs that met the inclusion criteria, 122 (36%) were initially contacted in order to obtain a final sample of at least 25% of the EDs in each province and territory. In total, 95 EDs (28%) of Canadian rural EDs participated in the study (participation rate = 78%). The proportions of rural EDs from each province and territory and the sociodemographic characteristics of the RSTs in question are presented in Tables 1 and 2. The location of the participating EDs and that of the Level 1 and Level 2 trauma centers are shown in Figure 1.

Table 1. Proportions of rural EDs included in the study by province or territory

Province or Territory	EDs (n)	Proportion of rural EDs included in the study
All	95	28%
Alberta	17	26%
British Columbia	9	26%
Manitoba	12	27%
New Brunswick	3	27%
Ontario	17	27%
Quebec	7	27%
Saskatchewan	13	27%
Nova Scotia	5	29%
Newfoundland and Labrador	8	35%
Nunavut	1	50%
Prince Edward Island	1	100%
Northwest Territories	1	100%
Yukon	1	100%

Table 2. Sociodemographic characteristics of the rural small towns in which the participating EDs were located

Sociodemographic Characteristic	Mean	Standard deviation	Range
Population	5,781.89	7,247.96	172 to 45,212
Population density per square kilometer	216.81	219.20	0.6 to 956.1
Median age of the population	41.56	5.91	20.5 to 53.8
Median income (\$) (People 15 years of age and over)	23,778.33	5,772.15	3,792 to 44,885
Median income after tax (\$) (People 15 years of age and over)	21,735.48	4,641.68	3,792 to 37,985

Data from Statistics Canada[31].

Figure 1. Location of the RST EDs included in the study and that of the Level 1 and 2 trauma centers

See Figure 1 in a separate digital file named Figure_1_map_Canada25.

Legend to Figure 1: The RST EDs included in the study are identified on the map with yellow markers. The red stars represent Level 1 trauma centers (see Hameed *et al.*[26] for the definition of trauma centers). The blue circles represent Level 2 trauma centers (see Hameed *et al.*[26] for the definition of trauma centers).

The general characteristics of the rural EDs and the results concerning 24/7 access to services and consultants are presented in Tables 3 and 4. To summarize, RST hospitals had on average of 23 acute care beds and 7 ED stretchers and averaged 13,500 annual ED visits. Apart from basic laboratory and X-ray services, the majority of the rural EDs had limited access to professional and ancillary services. Forty-four and 54 percent of the RST EDs are more than 300 km from a Level 1 and Level 2 trauma center, respectively.

Table 3. General characteristics of the rural hospitals

Annual ED patient visits (AVG ± SD)	13,458 ± 8,853
ED stretchers (AVG ± SD)	6.8 ± 3.9
Acute-care beds (AVG ± SD)	23.0 ± 17.7
Long-term beds (AVG ± SD)	18.7 ± 23.8
Local ICU	16.8% (<i>n</i> = 16/95)
EDs > 300 km from a Level 1 trauma center	44.2% (<i>n</i> = 42/95)
EDs > 300 km from a Level 2 trauma center	54.4% (<i>n</i> = 37/68) *

* This proportion was calculated for 68 EDs because 27 (28.4%, *n* = 27/95) do not have access to a Level 2 trauma center, according to Hameed’s list[26].

Table 4. 24/7 access to consultants, equipment and services in the rural EDs

Consultants	
Neurologist	0% (<i>n</i> = 0/95)
Pediatrician	5.3% (<i>n</i> = 5/95)
Orthopedist	6.3% (<i>n</i> = 6/95)
Obstetrician/gynecologist	9.5% (<i>n</i> = 9/95)
Psychiatrist	10.5% (<i>n</i> = 10/95)
Internist	11.6% (<i>n</i> = 11/95)
Surgeon	26.3% (<i>n</i> = 25/95)
Equipment and services	
Magnetic resonance imaging	2.1% (<i>n</i> = 2/95)
CT scanner	20.0% (<i>n</i> = 19/95)
Ultrasound	28.4% (<i>n</i> = 27/95)
Bedside ultrasound	48.4% (<i>n</i> = 46/95)
Basic X-ray	96.8% (<i>n</i> = 92/95)
Laboratory	98.9% (<i>n</i> = 94/95)

DISCUSSION

To the best of our knowledge, this is the first nationwide study examining access to services in Canada's rural EDs. The results of this study pertaining to a random sample of Canada's rural EDs suggest that these EDs have limited 24/7 local access to a CT scanner, consultants and an

ICU. A considerable proportion of these rural hospitals are more than 300 km from Level 1 and 2 trauma centers.

Although the current study does not permit representative comparisons between provinces, since a sample (28%) of rural EDs was included in this study, we recently reported considerable differences in access to these services between British Columbia (BC) and Quebec (QC)[12]. In short, 73% of QC's rural EDs have 24/7 access to a CT scanner compared to only 3% for BC. With respect to support services, 81% of QC's rural EDs have a 24/7 on-call general surgeon compared to 12% for BC. Also, a greater proportion of QC's rural EDs are supported by an intensive care unit than of those in BC (88% vs. 15%). It is still unclear if the level of services offered in rural EDs reflects ED volumes and how the availability of these services affects interfacility transport issues and patient outcomes. It is also not known how different provincial policies influence the availability of these services. Nevertheless, these findings suggest potential nationwide variations in access to emergency care services.

A somewhat surprising finding in our study was the limited access to CT scanners in Canadian rural hospitals. These results significantly contrast with findings from US rural hospitals. CT scanners play an important role in the diagnosis and early triage of patients with acute and sometimes life-threatening illnesses, including stroke, major trauma, head injury, pulmonary embolism, and abdominal pain. Urban and community hospitals have almost universal access to CT scanners, and their use during ED visits has increased 330%, from 3.2% of encounters in 1996 to 13.9% in 2007[32]. Even if some of these exams could be considered superfluous in the context of increased awareness of the risks of ionizing radiation[33], some clinical situations

clearly require emergent CT scanning, and many guidelines and clinical decision rules can better guide its use[34].

The first CT scanner in a rural setting in Canada was installed in 1999 in Walkerton, Ontario, a town 160 km north of London (population of 5,036 at the time)[35]. It was installed as part of a pilot study, which was cut short because of positive outcomes. It is unclear why, according to our study, 80% of rural EDs do not have access to this technology more than a decade later. If we conservatively estimate the CT scanning needs at the rural hospitals studied to be 10% of emergency visits, an average of 1,346 patients would require an interfacility transfer for this test alone.

Likewise, the impact of the minimal level of consultant and critical care services provided in rural hospitals should be examined from a viewpoint akin to that for CT services. Two Canadian studies examining the relationship between interfacility transport requirements and rural hospital services showed that most transfers from rural hospitals are for CT scanning, orthopedic care, neurologic diseases, and general surgical and critical care services[36 37]. While a nationwide prospective study on interfacility transport processes is awaited, several salient questions remain. How many patients can be safely managed in their communities? What reasonable level of local services should we provide to optimize the use of interfacility transport? As reported in this study, the limited level of services available in rural EDs likely requires more interfacility transport. How cost-effective, timely and safe an alternative this is to providing more services rurally needs to be determined.

Our finding that 44% of EDs are more than 300 km from a Level 1 trauma center and that 54%

are more than 300 km from a Level 2 trauma center is troubling, given the limited resources. There are clear benefits to managing trauma patients at these tertiary centers within the, albeit debated, timeframe of the “golden hour”[38]. However, these distances decrease the likelihood of patients obtaining this standard of care. Improving the level of local services and training of emergency professionals has been proposed as a solution to improving outcomes. Trauma care is particularly important in rural areas, where people are at greater risk for trauma and trauma death compared to their urban counterparts[19-23]. For example, Gomez *et al.*[21] observed that this risk was threefold greater for Ontario’s rural residents than for urban residents.

In order to legislate in favor of improved access to care in rural areas, evidence-based standards are required. The latest guidelines on the subject by the Canadian Association of Emergency Physicians were written in the context of health-care cuts and associated risks for patients[39]. This report was mainly based on expert opinion in the context of limited evidence on the subject at the time. The report did not make any specific recommendations as to the level of health-care services that should be provided locally in rural EDs.

Meanwhile, the province of Quebec has published provincial guidelines with sections addressing rural emergency care[40]. The Quebec guide defines what support services an ED should receive, based on the hospital’s designation. That designation is determined by several factors, including the annual number of patient visits. In 2006, this guide was revised with the goal of making all stakeholders accountable for quality of care in EDs. It is unclear if Quebec has been successful in implementing these recommendations or if they have led to increased access to quality care. We are conducting a study to examine this issue[41].

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3 Finally, in light of these results, as well as those from the landmark study by Joynt *et al.*[9],
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5 which showed poor outcomes for rural patients, Canadian health-care professionals and decision-
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7 makers should be pressed to examine the impact of the current level of health services available
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9 in rural EDs on patient outcomes and begin to think about solutions so that Canadians can access
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11 quality care no matter where they reside or visit. Otherwise, the spirit of Canada's universal
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13 health-care system, which is considered a defining feature of this country, would not be
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15 respected.
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20 21 22 LIMITATIONS

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24 This study relied on information provided through questionnaires and brief telephone interviews
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26 with local health-care providers. Information was obtained mainly from one source, and cross-
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28 checking with other databases was not possible. However, the information requested was
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30 straightforward and probably easily accessed by professionals working in these small RST EDs.
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36 To the best of our knowledge, the information obtained on 24/7 access to services in this study is
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38 not easily or reliably accessible through standardized databases in Canada[42]. Despite all the
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40 efforts to select a nationally representative sample of rural EDs from a random list for each
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42 province and territory, unique centers with higher or lower levels of local service resources
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44 may have been missed.
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50 Finally, we reported population statistics on the RSTs where the hospitals were located. We did
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52 not obtain data on the hospitals' service areas. It would have been interesting to estimate the
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54 populations and the size of the territories served by these rural hospitals. Our experience with
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56 this information in a pilot study is that it is difficult to reliably obtain and verify[12].
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CONCLUSION

This preliminary report on a national random sample of Canadian rural EDs suggests that there is limited access to advanced imaging and consultant services in these areas. A larger nationwide study is required to confirm these findings and permit meaningful interprovincial comparisons. Ultimately, a study aimed at examining the relationship between the level of service, interfacility transport requirements and patient outcomes is required. It would be helpful for provinces to uniformly collect, update and verify data on the services provided in rural hospitals and to provide better access to these databases.

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CONTRIBUTORS

R.F. had the original idea, designed the study, drafted the first version of the manuscript and is responsible of the final version. J.P. and P.A. assisted with the study design, the literature research and editing of the manuscript. J.V. and J.M-G. contributed to the study coordination,

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3 data analysis and preparation of the manuscript. All authors contributed to and have approved the
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5 final manuscript.
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10 **CONFLICT OF INTEREST**

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12 The authors declare not having any financial or other conflicts of interest related to the
13
14 submission. The manuscript has not been published, nor is it under consideration for publication
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16 elsewhere, in whole or in part in any language.
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21 **MEETINGS**

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23 Results have been presented as a moderated poster at the 2012 CAEP conference (June 2-6 2012)
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25 in Niagara Falls, Ontario, Canada (Volume 14; S1 of CJEM) and as an oral presentation at the
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27 Canadian Rural Health Research Society conference (October 25-27 2012) in Lévis, Québec,
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29 Canada.
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39
40 FRQS (RF), the Research Chair in Emergency Medicine Laval University – CHAU Hôtel-Dieu
41
42 de Lévis Hospital and the Hôtel-Dieu de Lévis Hospital research fund.
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48 **DATA SHARING**

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50 Data will not be automatically shared or distributed in a public forum. However, data will be
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52 made available upon request to the corresponding author on a case by case basis.
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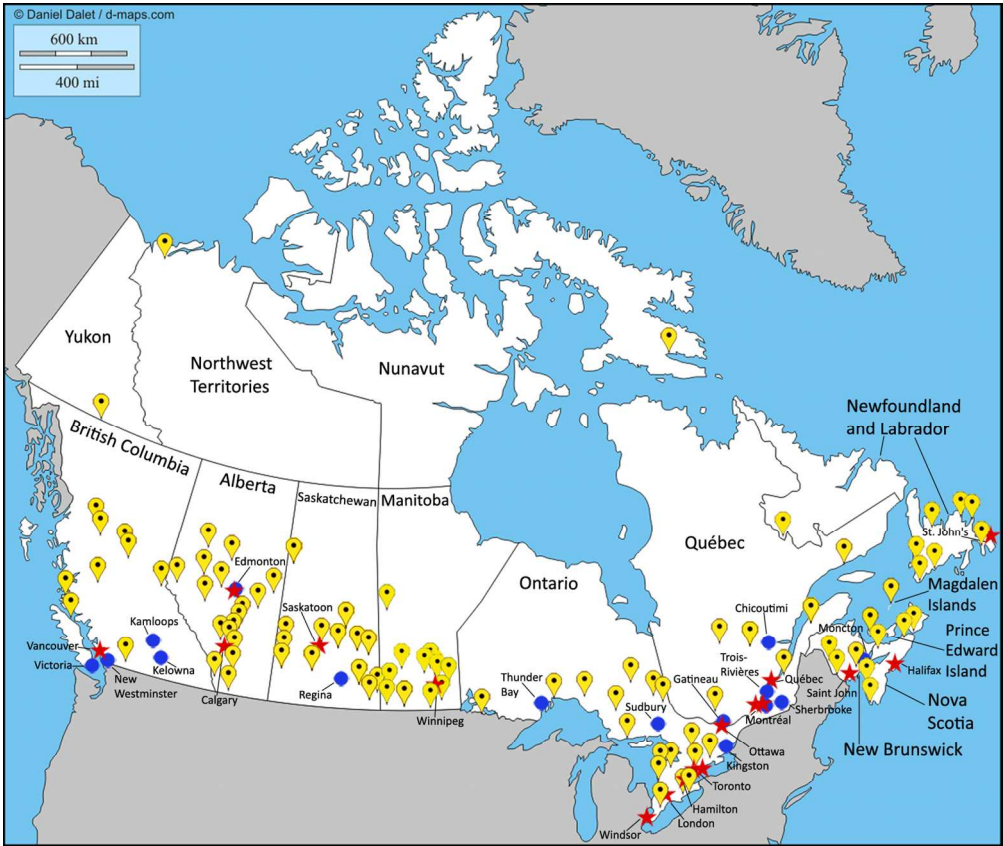


Figure 1. The RST EDs included in the study are identified on the map with yellow markers. The red stars represent Level 1 trauma centers (see Hameed et al.[26] for the definition of trauma centers). The blue circles represent Level 2 trauma centers (see Hameed et al.[26] for the definition of trauma centers). 404x341mm (100 x 100 DPI)

APPENDIX

Appendix 1. RST criteria set out in the Statistics Canada definition

RST Criteria			
Population		Population Density	
> 10,000	and	< 400/km ²	
Or			
< 10,000	and	> 400/km ²	
Or			
< 10,000	and	< 400/km ²	

RST = rural and small town



A descriptive study of access to services in a random sample of canadian rural emergency departments.

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Manuscripts

A descriptive study of access to services in a random sample of canadian rural emergency departments.

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WORD COUNT: 2,572

RUNNING HEAD: Access to rural emergency services in Canada

KEYWORDS: Emergency departments, Health services, Rural critical care, Rural emergency medicine, CT scan

ABSTRACT

Objective: To examine 24/7 access to services and consultants in a sample of Canadian rural emergency departments (EDs).

Design: Cross-sectional study - mixed methods (structured interview, survey and government data bases) with random sampling of hospitals.

Setting: Canadian rural EDs (rural small town (RST) definition - Statistics Canada).

Participants: 28% (95/336) of Canadian rural EDs providing 24/7 physician coverage located in hospitals with acute care hospitalization beds.

Main outcome measures: General characteristics of the rural EDs, information about 24/7 access to consultants, equipment and services, and the proportion of rural hospitals more than 300 km from Level 1 and 2 trauma centers.

Results: Of the 336 rural EDs identified, 122 (36%) were randomly selected and contacted. Overall, 95 participated in the study (participation rate, 78%). Hospitals had, on average, 23 acute-care beds, 7 ED stretchers and 13,500 annual ED visits. The proportion of rural hospitals with local access to the following 24/7 services was: pediatrician, 5%; obstetrician, 10%; psychiatrist, 11%; internist, 12%; intensive care unit, 17%; CT scanner, 20%; surgeon, 26%; ultrasound, 28%; basic X-ray, 97%; and laboratory services, 99%. Forty-four and 54 percent of the RST EDs were more than 300 km from a Level 1 and Level 2 trauma center, respectively.

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Conclusions: This is the first study describing the services available in Canadian rural EDs.

Apart from basic laboratory and X-ray services, most rural EDs have limited access to consultants, advanced imaging and critical care services. A detailed study is needed to evaluate the impact of these limited services on patient outcomes, costs and interfacility transport demands.

Trial registration: Not a registered trial.

For peer review only

ARTICLE SUMMARY

Article focus

- Examine and describe 24/7 access to comprehensive support services in a random sample of Canadian rural emergency departments (EDs).

Key messages

- Apart from basic laboratory and X-ray services, most Canadian rural EDs have limited 24/7 local access to consultant and imaging services.
- A considerable proportion of these rural hospitals are more than 300 km from Level 1 and 2 trauma centers.

Strengths and limitations of this study

- To the best of our knowledge, this is the first nationwide study examining access to services in Canada's rural EDs.
- The current study does not permit representative comparisons between provinces, since a sample of rural EDs was included in this study.
- The study did not examine patient outcomes in relation to the limited services provided in rural facilities.

INTRODUCTION

Approximately 20% of the Canadian population lives in rural or remote areas[1]. Providing sustainable access to emergency care in these areas is challenging[2]. In the context of limited resources and increased costs, there have been increased efforts to regionalize and centralize health-care services in rural Canada[3-6]. This has resulted in local service cuts and hospital closings[5 6]. Therefore, the current level of services offered in rural hospitals in Canada is unclear. Published data on the subject are scarce, and access to updated resource databases is both limited and sensitive[7]. Despite the accessibility clause of the *Canada Health Act*[8], the legislation overseeing the country’s publically funded universal health care-system, disparities in access to emergency care may exist.

Facing similar challenges, the US developed, in 1997, the Critical Access Hospital (CAH) Program to enhance access to health care in rural communities[9]. This legislation enables CAHs to receive cost-based reimbursement for Medicare beneficiaries with the goal of financially stabilizing hospitals in small and remote areas. The legislation also sought to enhance quality by imposing credentialing and quality assurance requirements. Yet, despite the creation of this program, recent reports showed that compared to non-CAH hospitals, CAH hospitals had fewer clinical capabilities, worse processes of care, and higher mortality rates for acute myocardial infarction, congestive heart failure and pneumonia[9] and ischemic stroke[10].

To the best of our knowledge, no comparable Canadian study has been conducted. While the vast majority of US rural hospitals have 24/7 local access to a CT scanner (94%)[11], surgical services (87%) and a significant proportion of ICUs (41%)[9], preliminary reports from

Canada[6 12] show that, at least in British Columbia, less than 15% of rural EDs have local 24/7 access to these services.

Limited access to services in rural areas may preferentially impact the provision of quality emergency care. The principles of emergency medicine rest on timely diagnosis and definitive treatment of life- or limb-threatening conditions. Timely access to diagnostic imaging and consultant support and tertiary trauma centers are essential components of emergency care. A lack of these services leads to an increased need for interfacility transport, with a resultant impact on staff, medical resources, technological support, transfer systems, local and referral center resources, patient costs, and patient safety[13 14]. Patient transfers also result in significant delays in providing definitive care[15], particularly in rural communities[16-19]. Moreover, in these communities, the risk of trauma and trauma death is greater than in urban areas[19-23], especially during the prehospital period[21 22].

The objective of this study was to examine and describe the current situation concerning access to comprehensive health-care services in a sample (25%) of Canadian rural hospitals.

METHODS

The protocol was submitted to our internal ethics review board (CHAU Hôtel-Dieu de Lévis) in June 2011. It was deemed not to require further ethics evaluation, based on the Tri-Council Policy Statement, as the research focused on the availability of services in public health-care facilities and did not involve human subjects.

Selection of rural EDs

We focused on rural EDs with 24/7 physician coverage at hospitals with acute-care hospitalization beds. To facilitate eventual comparisons with EDs elsewhere, we excluded community health centers and clinics, nursing stations, mobile health units, and private facilities. We consulted the Division of Geography at Statistics Canada to use their definition of “rural and small town” (RST)[24] (see Appendix 1). Briefly, they consider RSTs “towns and municipalities outside the commuting zone of larger urban centers (i.e. outside the commuting zone of centers with a population of 10,000 or more)”.

EDs in RST communities were then identified using the *Guide to Canadian Healthcare Facilities*[25]. The hospitals’ status was then confirmed with the provincial health ministries by phone or e-mail. Furthermore, the list of RSTs where the participating centers were located was submitted to Statistics Canada for confirmation. In the end, 336 RST EDs were identified.

Procedure for random sampling

The complete list of the 336 rural EDs, stratified for the provinces and territories, was submitted to an independent biostatistician, who generated a list of randomly ordered hospitals within each stratum. Our objective was to obtain data from at least 25% of the hospitals in each province and territory. To allow for the refusal to participate, the first 36% (n=122) of the hospitals listed within each stratum were initially contacted.

Data collection

As a first step, we sought to obtain data on ED patient volumes, local 24/7 access to consultant support, imaging services, access to intensive care unit (ICU) beds, and the distance to designated

Level 1 and Level 2 trauma centers (see Hameed *et al.*[26] for the definition and identification of trauma centers), which was calculated with Google Maps[27]. This Web-based mapping/geographic information system provides valid estimates of road distances at low cost, it has fewer usability problems than other similar systems[28], and it has been used previously in health care[29 30].

Data were collected between July and December 2011 by research assistants as well as medical students doing a research rotation. Data were collected from a questionnaire completed by the ED managers, and when necessary, a brief (10-minute) telephone interview was administered to complete the missing data. Government databases and official websites (e.g., those of provincial health ministries) were also used as sources of information.

Data entry and analysis

All data entry was verified by a second research assistant. Descriptive statistics are presented as percentages, means and standard deviations (SDs).

RESULTS

Of the 336 rural EDs that met the inclusion criteria, 122 (36%) were initially contacted in order to obtain a final sample of at least 25% of the EDs in each province and territory. In total, 95 EDs (28%) of Canadian rural EDs participated in the study (participation rate = 78%). The proportions of rural EDs from each province and territory and the sociodemographic characteristics of the RSTs in question are presented in Tables 1 and 2. The location of the participating EDs and that of the Level 1 and Level 2 trauma centers are shown in Figure 1.

Table 1. Proportions of rural EDs included in the study by province or territory

Province or Territory	EDs (<i>n</i>)	Proportion of rural EDs included in the study
All	95	28%
Alberta	17	26%
British Columbia	9	26%
Manitoba	12	27%
New Brunswick	3	27%
Ontario	17	27%
Quebec	7	27%
Saskatchewan	13	27%
Nova Scotia	5	29%
Newfoundland and Labrador	8	35%
Nunavut	1	50%
Prince Edward Island	1	100%
Northwest Territories	1	100%
Yukon	1	100%

Table 2. Sociodemographic characteristics of the rural small towns in which the participating EDs were located

Sociodemographic Characteristic	Mean	Standard deviation	Range
Population	5,781.89	7,247.96	172 to 45,212
Population density per square kilometer	216.81	219.20	0.6 to 956.1
Median age of the population	41.56	5.91	20.5 to 53.8
Median income (\$) (People 15 years of age and over)	23,778.33	5,772.15	3,792 to 44,885
Median income after tax (\$) (People 15 years of age and over)	21,735.48	4,641.68	3,792 to 37,985

Data from Statistics Canada[31].

Figure 1. Location of the RST EDs included in the study and that of the Level 1 and 2 trauma centers

See Figure 1 in a separate digital file named Figure_1_map_Canada25.

Legend to Figure 1: The RST EDs included in the study are identified on the map with yellow markers. The red stars represent Level 1 trauma centers (see Hameed *et al.*[26] for the definition of trauma centers). The blue circles represent Level 2 trauma centers (see Hameed *et al.*[26] for the definition of trauma centers).

The general characteristics of the rural EDs and the results concerning 24/7 access to services and consultants are presented in Tables 3 and 4. To summarize, RST hospitals had on average of 23 acute care beds and 7 ED stretchers and averaged 13,500 annual ED visits. Apart from basic laboratory and X-ray services, the majority of the rural EDs had limited access to professional and ancillary services. Forty-four and 54 percent of the RST EDs are more than 300 km from a Level 1 and Level 2 trauma center, respectively.

Table 3. General characteristics of the 95 Canadian rural EDs participating in the study

Annual ED patient visits (AVG ± SD)	13,458 ± 8,853
ED stretchers (AVG ± SD)	6.8 ± 3.9
Acute-care beds (AVG ± SD)	23.0 ± 17.7
Long-term beds (AVG ± SD)	18.7 ± 23.8
Local ICU	16.8% (<i>n</i> = 16/95)
EDs > 300 km from a Level 1 trauma center	44.2% (<i>n</i> = 42/95)
EDs > 300 km from a Level 2 trauma center	54.4% (<i>n</i> = 37/68) *

* This proportion was calculated for 68 EDs because 27 (28.4%, *n* = 27/95) do not have access to a Level 2 trauma center, according to Hameed’s list[26].

Table 4. Proportion of 24/7 access to consultants, equipment and services in the 95 Canadian rural EDs participating in the study

Consultants	
Neurologist	0% (<i>n</i> = 0/95)
Pediatrician	5.3% (<i>n</i> = 5/95)
Orthopedist	6.3% (<i>n</i> = 6/95)
Obstetrician/gynecologist	9.5% (<i>n</i> = 9/95)
Psychiatrist	10.5% (<i>n</i> = 10/95)
Internist	11.6% (<i>n</i> = 11/95)
Surgeon	26.3% (<i>n</i> = 25/95)
Equipment and services	
Magnetic resonance imaging	2.1% (<i>n</i> = 2/95)
CT scanner	20.0% (<i>n</i> = 19/95)
Ultrasound	28.4% (<i>n</i> = 27/95)
Bedside ultrasound	48.4% (<i>n</i> = 46/95)
Basic X-ray	96.8% (<i>n</i> = 92/95)
Laboratory	98.9% (<i>n</i> = 94/95)

DISCUSSION

To the best of our knowledge, this is the first nationwide study examining access to services in Canada’s rural EDs. The results of this study pertaining to a random sample of Canada’s rural EDs suggest that these EDs have limited 24/7 local access to a CT scanner, consultants and an ICU. A considerable proportion of these rural hospitals are more than 300 km from Level 1 and 2 trauma centers.

Although the current study does not permit representative comparisons between provinces, since a sample (28%) of rural EDs was included in this study, we recently reported considerable differences in access to these services between British Columbia (BC) and Quebec (QC)[12]. In short, 73% of QC’s rural EDs have 24/7 access to a CT scanner compared to only 3% for BC. With respect to support services, 81% of QC’s rural EDs have a 24/7 on-call general surgeon compared to 12% for BC. Also, a greater proportion of QC’s rural EDs are supported by an intensive care unit than of those in BC (88% vs. 15%). It is still unclear if the level of services offered in rural EDs reflects ED volumes and how the availability of these services affects interfacility transport issues and patient outcomes. It is also not known how different provincial policies influence the availability of these services. Nevertheless, these findings suggest potential nationwide variations in access to emergency care services.

A somewhat surprising finding in our study was the limited access to CT scanners in Canadian rural hospitals. These results significantly contrast with findings from US rural hospitals. CT scanners play an important role in the diagnosis and early triage of patients with acute and sometimes life-threatening illnesses, including stroke, major trauma, head injury, pulmonary embolism, and abdominal pain. Urban and community hospitals have almost universal access to

CT scanners, and their use during ED visits has increased 330%, from 3.2% of encounters in 1996 to 13.9% in 2007[32]. Even if some of these exams could be considered superfluous in the context of increased awareness of the risks of ionizing radiation[33], some clinical situations clearly require emergent CT scanning, and many guidelines and clinical decision rules can better guide its use[34].

The first CT scanner in a rural setting in Canada was installed in 1999 in Walkerton, Ontario, a town 160 km north of London (population of 5,036 at the time)[35]. It was installed as part of a pilot study, which was cut short because of positive outcomes. It is unclear why, according to our study, 80% of rural EDs do not have access to this technology more than a decade later. If we conservatively estimate the CT scanning needs at the rural hospitals studied to be 10% of emergency visits, an average of 1,346 patients would require an interfacility transfer for this test alone.

Likewise, the impact of the minimal level of consultant and critical care services provided in rural hospitals should be examined from a viewpoint akin to that for CT services. Two Canadian studies examining the relationship between interfacility transport requirements and rural hospital services showed that most transfers from rural hospitals are for CT scanning, orthopedic care, neurologic diseases, and general surgical and critical care services[36 37]. While a nationwide prospective study on interfacility transport processes is awaited, several salient questions remain. How many patients can be safely managed in their communities? What reasonable level of local services should we provide to optimize the use of interfacility transport? As reported in this study, the limited level of services available in rural EDs likely requires more interfacility transport. How cost-effective, timely and safe an alternative this is to providing more services

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8 Our finding that 44% of EDs are more than 300 km from a Level 1 trauma center and that 54%
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10 are more than 300 km from a Level 2 trauma center is troubling, given the limited resources.
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12 There are clear benefits to managing trauma patients at these tertiary centers within the albeit
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14 debated timeframe of the “golden hour”[38]. However, these distances decrease the likelihood of
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16 patients obtaining this standard of care. Improving the level of local services and training of
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18 emergency professionals has been proposed as a solution to improving outcomes. Trauma care is
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20 particularly important in rural areas, where people are at greater risk for trauma and trauma death
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22 compared to their urban counterparts[19-23]. For example, Gomez *et al.*[21] observed that this
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24 risk was threefold greater for Ontario’s rural residents than for urban residents.
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32 In order to legislate in favor of improved access to care in rural areas, evidence-based standards
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34 are required. The latest guidelines on the subject by the Canadian Association of Emergency
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36 Physicians were written in the context of health-care cuts and associated risks for patients[39].
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38 This report was mainly based on expert opinion in the context of limited evidence on the subject
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40 at the time. The report did not make any specific recommendations as to the level of health-care
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42 services that should be provided locally in rural EDs.
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48 Meanwhile, the province of Quebec has published provincial guidelines with sections addressing
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50 rural emergency care[40]. The Quebec guide defines what support services an ED should receive,
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52 based on the hospital’s designation. That designation is determined by several factors, including
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54 the annual number of patient visits. In 2006, this guide was revised with the goal of making all
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56 stakeholders accountable for quality of care in EDs. It is unclear if Quebec has been successful in
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3 implementing these recommendations or if they have led to increased access to quality care. We
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5 are conducting a study to examine this issue[41].
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10 Finally, in light of these results, as well as those from the landmark study by Joynt *et al.*[9],
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12 which showed poor outcomes for rural patients, Canadian health-care professionals and decision-
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14 makers should be pressed to examine the impact of the current level of health services available
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16 in rural EDs on patient outcomes and begin to think about solutions so that Canadians can access
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18 quality care no matter where they reside or visit. Otherwise, the spirit of Canada's universal
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20 health-care system, which is considered a defining feature of this country, would not be
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22 respected.
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29 LIMITATIONS

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31 This study relied on information provided through questionnaires and brief telephone interviews
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33 with local health-care providers. Information was obtained mainly from one source, and cross-
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35 checking with other databases was not possible. However, the information requested was
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37 straightforward and probably easily accessed by professionals working in these small RST EDs.
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43 To the best of our knowledge, the information obtained on 24/7 access to services in this study is
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45 not easily or reliably accessible through standardized databases in Canada[42]. Despite all the
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47 efforts to select a nationally representative sample of rural EDs from a random list for each
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49 province and territory, unique centers with higher or lower levels of local service resources
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51 may have been missed. Also, some hospitals may have refused to participate in the study because
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53 they are well equipped in terms of imaging or consulting services and may have been less
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55 interested in the project. However, the high overall participation rate minimizes this potential
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selection bias.

Another limitation of our study is the lack of estimation of the travel time to Level 1 and 2 trauma centers in combination with the distance estimations. Total inter-facility transfer times (call from rural EDs to arrival at Level 1 and 2 Trauma center) would better represent the care pathways of these patients factoring in weather, geography, roadwork, and of course overall transport capabilities. We are planning such a study.

Finally, we reported population statistics on the RSTs where the hospitals were located. We did not obtain data on the hospitals' service areas. It would have been interesting to estimate the populations and the size of the territories served by these rural hospitals. Our experience with this information in a pilot study is that it is difficult to reliably obtain and verify[12].

CONCLUSION

This preliminary report on a national random sample of Canadian rural EDs suggests that there is limited access to advanced imaging and consultant services in these areas. A larger nationwide study is required to confirm these findings and permit meaningful interprovincial comparisons. Ultimately, a study aimed at examining the relationship between the level of service, interfacility transport requirements and patient outcomes is required. It would be helpful for provinces to uniformly collect, update and verify data on the services provided in rural hospitals and to provide better access to these databases.

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CONTRIBUTORS

R.F. had the original idea, designed the study, drafted the first version of the manuscript and is responsible of the final version. J.P. and P.A. assisted with the study design, the literature research and editing of the manuscript. J.V. and J.M-G. contributed to the study coordination, data analysis and preparation of the manuscript. All authors contributed to and have approved the final manuscript.

CONFLICT OF INTEREST

The authors declare not having any financial or other conflicts of interest related to the submission. The manuscript has not been published, nor is it under consideration for publication elsewhere, in whole or in part in any language.

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MEETINGS

Results have been presented as a moderated poster at the 2012 CAEP conference (June 2-6 2012) in Niagara Falls, Ontario, Canada (Volume 14; S1 of CJEM) and as an oral presentation at the Canadian Rural Health Research Society conference (October 25-27 2012) in Lévis, Québec, Canada.

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DATA SHARING

Data will not be automatically shared or distributed in a public forum. However, data will be made available upon request to the corresponding author on a case by case basis.

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Limited Access to Services in Canadian Rural Emergency Departments: A Preliminary Study

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RUNNING HEAD: Access to rural emergency services in Canada

KEYWORDS: Emergency departments, Health services, Rural critical care, Rural emergency medicine, CT scan

ABSTRACT

Objective: To examine 24/7 access to services and consultants in a sample of Canadian rural emergency departments (EDs).

Design: Cross-sectional study - mixed methods (structured interview, survey and government data bases) with random sampling of hospitals.

Setting: Canadian rural EDs (rural small town (RST) definition - Statistics Canada).

Participants: 28% (95/336) of Canadian rural EDs providing 24/7 physician coverage located in hospitals with acute care hospitalization beds.

Main outcome measures: General characteristics of the rural EDs, information about 24/7 access to consultants, equipment and services, and the proportion of rural hospitals more than 300 km from Level 1 and 2 trauma centers.

Results: Of the 336 rural EDs identified, 122 (36%) were randomly selected and contacted.

Overall, 95 participated in the study (participation rate, 78%). Hospitals had, on average, 23 acute-care beds, 7 ED stretchers and 13,500 annual ED visits. The proportion of rural hospitals with local access to the following 24/7 services was: pediatrician, 5%; obstetrician, 10%; psychiatrist, 11%; internist, 12%; intensive care unit, 17%; CT scanner, 20%; surgeon, 26%; ultrasound, 28%; basic X-ray, 97%; and laboratory services, 99%. Forty-four and 54 percent of the RST EDs were more than 300 km from a Level 1 and Level 2 trauma center, respectively.

Conclusions: This is the first study describing the services available in Canadian rural EDs.

Apart from basic laboratory and X-ray services, most rural EDs have limited access to consultants, advanced imaging and critical care services. A detailed study is needed to evaluate the impact of these limited services on patient outcomes, costs and interfacility transport demands.

Trial registration: Not a registered trial.

For peer review only

ARTICLE SUMMARY

Article focus

- Examine and describe 24/7 access to comprehensive support services in a random sample of Canadian rural emergency departments (EDs).

Key messages

- Apart from basic laboratory and X-ray services, most Canadian rural EDs have limited 24/7 local access to consultant and imaging services.
- A considerable proportion of these rural hospitals are more than 300 km from Level 1 and 2 trauma centers.

Strengths and limitations of this study

- To the best of our knowledge, this is the first nationwide study examining access to services in Canada’s rural EDs.
- The current study does not permit representative comparisons between provinces, since a sample of rural EDs was included in this study.
- The study did not examine patient outcomes in relation to the limited services provided in rural facilities.

INTRODUCTION

Approximately 20% of the Canadian population lives in rural or remote areas[1]. Providing sustainable access to emergency care in these areas is challenging[2]. In the context of limited resources and increased costs, there have been increased efforts to regionalize and centralize health-care services in rural Canada[3-6]. This has resulted in local service cuts and hospital closings[5 6]. Therefore, the current level of services offered in rural hospitals in Canada is unclear. Published data on the subject are scarce, and access to updated resource databases is both limited and sensitive[7]. Despite the accessibility clause of the *Canada Health Act*[8], the legislation overseeing the country's publically funded universal health care-system, disparities in access to emergency care may exist.

Facing similar challenges, the US developed, in 1997, the Critical Access Hospital (CAH) Program to enhance access to health care in rural communities[9]. This legislation enables CAHs to receive cost-based reimbursement for Medicare beneficiaries with the goal of financially stabilizing hospitals in small and remote areas. The legislation also sought to enhance quality by imposing credentialing and quality assurance requirements. Yet, despite the creation of this program, recent reports showed that compared to non-CAH hospitals, CAH hospitals had fewer clinical capabilities, worse processes of care, and higher mortality rates for acute myocardial infarction, congestive heart failure and pneumonia[9] and ischemic stroke[10].

To the best of our knowledge, no comparable Canadian study has been conducted. While the vast majority of US rural hospitals have 24/7 local access to a CT scanner (94%)[11], surgical services (87%) and a significant proportion of ICUs (41%)[9], preliminary reports from

Canada[6 12] show that, at least in British Columbia, less than 15% of rural EDs have local 24/7 access to these services.

Limited access to services in rural areas may preferentially impact the provision of quality emergency care. The principles of emergency medicine rest on timely diagnosis and definitive treatment of life- or limb-threatening conditions. Timely access to diagnostic imaging and consultant support and tertiary trauma centers are essential components of emergency care. A lack of these services leads to an increased need for interfacility transport, with a resultant impact on staff, medical resources, technological support, transfer systems, local and referral center resources, patient costs, and patient safety[13 14]. Patient transfers also result in significant delays in providing definitive care[15], particularly in rural communities[16-19]. Moreover, in these communities, the risk of trauma and trauma death is greater than in urban areas[19-23], especially during the prehospital period[21 22].

The objective of this study was to examine and describe the current situation concerning access to comprehensive health-care services in a sample (25%) of Canadian rural hospitals.

METHODS

The protocol was submitted to our internal ethics review board (CHAU Hôtel-Dieu de Lévis) in June 2011. It was deemed not to require further ethics evaluation, based on the Tri-Council Policy Statement, as the research focused on the availability of services in public health-care facilities and did not involve human subjects.

Selection of rural EDs

We focused on rural EDs with 24/7 physician coverage at hospitals with acute-care hospitalization beds. To facilitate eventual comparisons with EDs elsewhere, we excluded community health centers and clinics, nursing stations, mobile health units, and private facilities. We consulted the Division of Geography at Statistics Canada to use their definition of “rural and small town” (RST)[24] (see Appendix 1). Briefly, they consider RSTs “towns and municipalities outside the commuting zone of larger urban centers (i.e. outside the commuting zone of centers with a population of 10,000 or more)”.

EDs in RST communities were then identified using the *Guide to Canadian Healthcare Facilities*[25]. The hospitals’ status was then confirmed with the provincial health ministries by phone or e-mail. Furthermore, the list of RSTs where the participating centers were located was submitted to Statistics Canada for confirmation. In the end, 336 RST EDs were identified.

Procedure for random sampling

The complete list of the 336 rural EDs, stratified for the provinces and territories, was submitted to an independent biostatistician, who generated a list of randomly ordered hospitals within each stratum. Our objective was to obtain data from at least 25% of the hospitals in each province and territory. To allow for the refusal to participate, the first 36% (n=122) of the hospitals listed within each stratum were initially contacted.

Data collection

As a first step, we sought to obtain data on ED patient volumes, local 24/7 access to consultant support, imaging services, access to intensive care unit (ICU) beds, and the distance to designated

Level 1 and Level 2 trauma centers (see Hameed *et al.*[26] for the definition and identification of trauma centers), which was calculated with Google Maps[27]. This Web-based mapping/geographic information system provides valid estimates of road distances at low cost, it has fewer usability problems than other similar systems[28], and it has been used previously in health care[29 30].

Data were collected between July and December 2011 by research assistants as well as medical students doing a research rotation. Data were collected from a questionnaire completed by the ED managers, and when necessary, a brief (10-minute) telephone interview was administered to complete the missing data. Government databases and official websites (e.g., those of provincial health ministries) were also used as sources of information.

Data entry and analysis

All data entry was verified by a second research assistant. Descriptive statistics are presented as percentages, means and standard deviations (SDs).

RESULTS

Of the 336 rural EDs that met the inclusion criteria, 122 (36%) were initially contacted in order to obtain a final sample of at least 25% of the EDs in each province and territory. In total, 95 EDs (28%) of Canadian rural EDs participated in the study (participation rate = 78%). The proportions of rural EDs from each province and territory and the sociodemographic characteristics of the RSTs in question are presented in Tables 1 and 2. The location of the participating EDs and that of the Level 1 and Level 2 trauma centers are shown in Figure 1.

Table 1. Proportions of rural EDs included in the study by province or territory

Province or Territory	EDs (<i>n</i>)	Proportion of rural EDs included in the study
All	95	28%
Alberta	17	26%
British Columbia	9	26%
Manitoba	12	27%
New Brunswick	3	27%
Ontario	17	27%
Quebec	7	27%
Saskatchewan	13	27%
Nova Scotia	5	29%
Newfoundland and Labrador	8	35%
Nunavut	1	50%
Prince Edward Island	1	100%
Northwest Territories	1	100%
Yukon	1	100%

Table 2. Sociodemographic characteristics of the rural small towns in which the participating EDs were located

Sociodemographic Characteristic	Mean	Standard deviation	Range
Population	5,781.89	7,247.96	172 to 45,212
Population density per square kilometer	216.81	219.20	0.6 to 956.1
Median age of the population	41.56	5.91	20.5 to 53.8
Median income (\$) (People 15 years of age and over)	23,778.33	5,772.15	3,792 to 44,885
Median income after tax (\$) (People 15 years of age and over)	21,735.48	4,641.68	3,792 to 37,985

Data from Statistics Canada[31].

Figure 1. Location of the RST EDs included in the study and that of the Level 1 and 2 trauma centers

See Figure 1 in a separate digital file named Figure_1_map_Canada25.

Legend to Figure 1: The RST EDs included in the study are identified on the map with yellow markers. The red stars represent Level 1 trauma centers (see Hameed *et al.*[26] for the definition of trauma centers). The blue circles represent Level 2 trauma centers (see Hameed *et al.*[26] for the definition of trauma centers).

The general characteristics of the rural EDs and the results concerning 24/7 access to services and consultants are presented in Tables 3 and 4. To summarize, RST hospitals had on average of 23 acute care beds and 7 ED stretchers and averaged 13,500 annual ED visits. Apart from basic laboratory and X-ray services, the majority of the rural EDs had limited access to professional and ancillary services. Forty-four and 54 percent of the RST EDs are more than 300 km from a Level 1 and Level 2 trauma center, respectively.

Table 3. General characteristics of the 95 Canadian rural EDs participating in the study

Annual ED patient visits (AVG ± SD)	13,458 ± 8,853
ED stretchers (AVG ± SD)	6.8 ± 3.9
Acute-care beds (AVG ± SD)	23.0 ± 17.7
Long-term beds (AVG ± SD)	18.7 ± 23.8
Local ICU	16.8% (<i>n</i> = 16/95)
EDs > 300 km from a Level 1 trauma center	44.2% (<i>n</i> = 42/95)
EDs > 300 km from a Level 2 trauma center	54.4% (<i>n</i> = 37/68) *

* This proportion was calculated for 68 EDs because 27 (28.4%, *n* = 27/95) do not have access to a Level 2 trauma center, according to Hameed's list[26].

Table 4. Proportion of 24/7 access to consultants, equipment and services in the 95 Canadian rural EDs participating in the study

Consultants	
Neurologist	0% (<i>n</i> = 0/95)
Pediatrician	5.3% (<i>n</i> = 5/95)
Orthopedist	6.3% (<i>n</i> = 6/95)
Obstetrician/gynecologist	9.5% (<i>n</i> = 9/95)
Psychiatrist	10.5% (<i>n</i> = 10/95)
Internist	11.6% (<i>n</i> = 11/95)
Surgeon	26.3% (<i>n</i> = 25/95)
Equipment and services	
Magnetic resonance imaging	2.1% (<i>n</i> = 2/95)
CT scanner	20.0% (<i>n</i> = 19/95)
Ultrasound	28.4% (<i>n</i> = 27/95)
Bedside ultrasound	48.4% (<i>n</i> = 46/95)
Basic X-ray	96.8% (<i>n</i> = 92/95)
Laboratory	98.9% (<i>n</i> = 94/95)

DISCUSSION

To the best of our knowledge, this is the first nationwide study examining access to services in Canada's rural EDs. The results of this study pertaining to a random sample of Canada's rural EDs suggest that these EDs have limited 24/7 local access to a CT scanner, consultants and an ICU. A considerable proportion of these rural hospitals are more than 300 km from Level 1 and 2 trauma centers.

Although the current study does not permit representative comparisons between provinces, since a sample (28%) of rural EDs was included in this study, we recently reported considerable differences in access to these services between British Columbia (BC) and Quebec (QC)[12]. In short, 73% of QC's rural EDs have 24/7 access to a CT scanner compared to only 3% for BC. With respect to support services, 81% of QC's rural EDs have a 24/7 on-call general surgeon compared to 12% for BC. Also, a greater proportion of QC's rural EDs are supported by an intensive care unit than of those in BC (88% vs. 15%). It is still unclear if the level of services offered in rural EDs reflects ED volumes and how the availability of these services affects interfacility transport issues and patient outcomes. It is also not known how different provincial policies influence the availability of these services. Nevertheless, these findings suggest potential nationwide variations in access to emergency care services.

A somewhat surprising finding in our study was the limited access to CT scanners in Canadian rural hospitals. These results significantly contrast with findings from US rural hospitals. CT scanners play an important role in the diagnosis and early triage of patients with acute and sometimes life-threatening illnesses, including stroke, major trauma, head injury, pulmonary embolism, and abdominal pain. Urban and community hospitals have almost universal access to

CT scanners, and their use during ED visits has increased 330%, from 3.2% of encounters in 1996 to 13.9% in 2007[32]. Even if some of these exams could be considered superfluous in the context of increased awareness of the risks of ionizing radiation[33], some clinical situations clearly require emergent CT scanning, and many guidelines and clinical decision rules can better guide its use[34].

The first CT scanner in a rural setting in Canada was installed in 1999 in Walkerton, Ontario, a town 160 km north of London (population of 5,036 at the time)[35]. It was installed as part of a pilot study, which was cut short because of positive outcomes. It is unclear why, according to our study, 80% of rural EDs do not have access to this technology more than a decade later. If we conservatively estimate the CT scanning needs at the rural hospitals studied to be 10% of emergency visits, an average of 1,346 patients would require an interfacility transfer for this test alone.

Likewise, the impact of the minimal level of consultant and critical care services provided in rural hospitals should be examined from a viewpoint akin to that for CT services. Two Canadian studies examining the relationship between interfacility transport requirements and rural hospital services showed that most transfers from rural hospitals are for CT scanning, orthopedic care, neurologic diseases, and general surgical and critical care services[36 37]. While a nationwide prospective study on interfacility transport processes is awaited, several salient questions remain. How many patients can be safely managed in their communities? What reasonable level of local services should we provide to optimize the use of interfacility transport? As reported in this study, the limited level of services available in rural EDs likely requires more interfacility transport. How cost-effective, timely and safe an alternative this is to providing more services

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8 Our finding that 44% of EDs are more than 300 km from a Level 1 trauma center and that 54%
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10 are more than 300 km from a Level 2 trauma center is troubling, given the limited resources.

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12 There are clear benefits to managing trauma patients at these tertiary centers within the albeit
13 debated timeframe of the “golden hour”[38]. However, these distances decrease the likelihood of
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15 patients obtaining this standard of care. Improving the level of local services and training of
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17 emergency professionals has been proposed as a solution to improving outcomes. Trauma care is
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19 particularly important in rural areas, where people are at greater risk for trauma and trauma death
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21 compared to their urban counterparts[19-23]. For example, Gomez *et al.*[21] observed that this
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23 risk was threefold greater for Ontario’s rural residents than for urban residents.
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32 In order to legislate in favor of improved access to care in rural areas, evidence-based standards
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34 are required. The latest guidelines on the subject by the Canadian Association of Emergency
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36 Physicians were written in the context of health-care cuts and associated risks for patients[39].
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38 This report was mainly based on expert opinion in the context of limited evidence on the subject
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40 at the time. The report did not make any specific recommendations as to the level of health-care
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42 services that should be provided locally in rural EDs.
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48 Meanwhile, the province of Quebec has published provincial guidelines with sections addressing
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50 rural emergency care[40]. The Quebec guide defines what support services an ED should receive,
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52 based on the hospital’s designation. That designation is determined by several factors, including
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54 the annual number of patient visits. In 2006, this guide was revised with the goal of making all
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56 stakeholders accountable for quality of care in EDs. It is unclear if Quebec has been successful in
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3 implementing these recommendations or if they have led to increased access to quality care. We
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5 are conducting a study to examine this issue[41].
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10 Finally, in light of these results, as well as those from the landmark study by Joynt *et al.*[9],
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12 which showed poor outcomes for rural patients, Canadian health-care professionals and decision-
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14 makers should be pressed to examine the impact of the current level of health services available
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16 in rural EDs on patient outcomes and begin to think about solutions so that Canadians can access
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18 quality care no matter where they reside or visit. Otherwise, the spirit of Canada’s universal
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20 health-care system, which is considered a defining feature of this country, would not be
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22 respected.
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29 **LIMITATIONS**
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31 This study relied on information provided through questionnaires and brief telephone interviews
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33 with local health-care providers. Information was obtained mainly from one source, and cross-
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35 checking with other databases was not possible. However, the information requested was
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37 straightforward and probably easily accessed by professionals working in these small RST EDs.
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43 To the best of our knowledge, the information obtained on 24/7 access to services in this study is
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45 not easily or reliably accessible through standardized databases in Canada[42]. Despite all the
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47 efforts to select a nationally representative sample of rural EDs from a random list for each
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49 province and territory, unique centers with higher or lower levels of local service resources
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51 may have been missed. Also, some hospitals may have refused to participate in the study because
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53 they are well equipped in terms of imaging or consulting services and may have been less
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55 interested in the project. However, the high overall participation rate minimizes this potential
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selection bias.

Another limitation of our study is the lack of estimation of the travel time to Level 1 and 2 trauma centers in combination with the distance estimations. Total inter-facility transfer times (call from rural EDs to arrival at Level 1 and 2 Trauma center) would better represent the care pathways of these patients factoring in weather, geography, roadwork, and of course overall transport capabilities. We are planning such a study.

Finally, we reported population statistics on the RSTs where the hospitals were located. We did not obtain data on the hospitals' service areas. It would have been interesting to estimate the populations and the size of the territories served by these rural hospitals. Our experience with this information in a pilot study is that it is difficult to reliably obtain and verify[12].

CONCLUSION

This preliminary report on a national random sample of Canadian rural EDs suggests that there is limited access to advanced imaging and consultant services in these areas. A larger nationwide study is required to confirm these findings and permit meaningful interprovincial comparisons. Ultimately, a study aimed at examining the relationship between the level of service, interfacility transport requirements and patient outcomes is required. It would be helpful for provinces to uniformly collect, update and verify data on the services provided in rural hospitals and to provide better access to these databases.

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CONTRIBUTORS

R.F. had the original idea, designed the study, drafted the first version of the manuscript and is responsible of the final version. J.P. and P.A. assisted with the study design, the literature research and editing of the manuscript. J.V. and J.M-G. contributed to the study coordination, data analysis and preparation of the manuscript. All authors contributed to and have approved the final manuscript.

CONFLICT OF INTEREST

The authors declare not having any financial or other conflicts of interest related to the submission. The manuscript has not been published, nor is it under consideration for publication elsewhere, in whole or in part in any language.

MEETINGS

Results have been presented as a moderated poster at the 2012 CAEP conference (June 2-6 2012) in Niagara Falls, Ontario, Canada (Volume 14; S1 of CJEM) and as an oral presentation at the Canadian Rural Health Research Society conference (October 25-27 2012) in Lévis, Québec, Canada.

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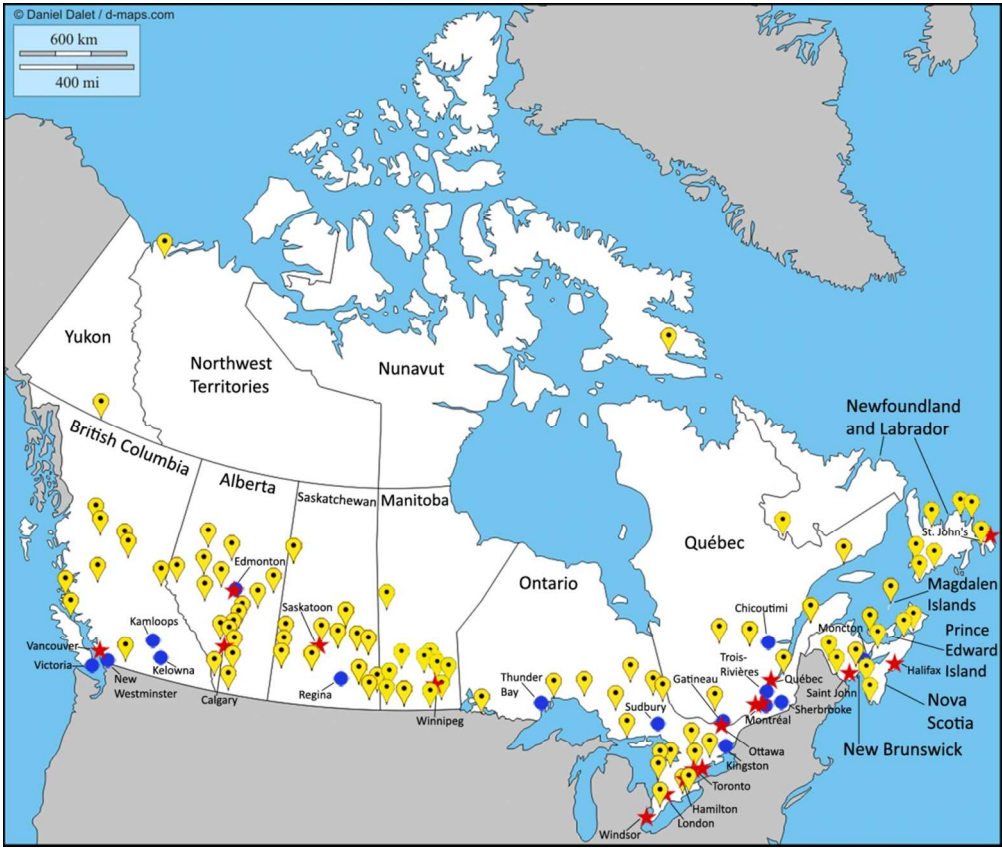


Figure 1. The RST EDs included in the study are identified on the map with yellow markers. The red stars represent Level 1 trauma centers (see Hameed et al.[26] for the definition of trauma centers). The blue circles represent Level 2 trauma centers (see Hameed et al.[26] for the definition of trauma centers).
106x90mm (300 x 300 DPI)

APPENDIX

Appendix 1. RST criteria set out in the Statistics Canada definition

RST Criteria			
	Population		Population Density
	> 10,000	and	< 400/km ²
Or			
	< 10,000	and	> 400/km ²
Or			
	< 10,000	and	< 400/km ²

RST = rural and small town